

# DEVICE FOR REMOVING DOSES OF PLASTIC MATERIAL FROM AN EXTRUDER

## Technical field

The present invention relates to a device for removing doses of plastic material from an extruder.

## Background art

Devices for removing doses of plastic material from an extruder and depositing them in input to a carousel that is adapted for example to form by compression molding articles such as closures, caps, liners and the like are currently known with particular reference to US 5,603,964, 5,807,592, and 5,811,044.

These devices are generally constituted by a rotating disk on which concave cup-like elements are distributed peripherally; said cups move along a circular path that is substantially tangent to the orifice for the outflow of the plastic material from the extruder; in their motion, the cups remove from said orifice, by scraping, preset quantities of plastic material, subsequently unloading them with the aid of pneumatic or mechanical means into respective cavities provided in the carousel, where they are then compressed in order to form the articles.

With such cups, the individual doses are formed by severing the flow of plastic material that exits from the extruder. This severing method causes alterations to the physical characteristics of the material, which though being localized, are memorized in the material and cause in the finished product defects that are sometimes not tolerable.

## Disclosure of the Invention

The aim of the present invention is to obviate the cited drawbacks by providing a device that is adapted to remove from the extruder doses of plastic material in the pasty state that maintain the intended physical and mechanical characteristics, thus producing finished products that are substantially free from defects.

Within this aim, an object of the present invention is to provide a removal device that is improved so as to work at a higher speed than conventional devices and is therefore capable of ensuring a higher productivity.

Another object of the present invention is to provide a structure that is  
5 simple and safe and effective in operation in order to be able to work with materials of different kinds.

This aim and these and other objects that will become better apparent hereinafter, are achieved by the present device for removing doses of plastic material from an extruder by means of at least one removal element that can  
10 move with respect to said extruder and is provided with a receptacle for a dose removed from the outflow orifice of said extruder, characterized in that said removal element comprises a severing element that is adapted to cut into the plastic material dispensed by said extruder along a severing edge that advances through the material from one side of said orifice to the other,  
15 and in that said receptacle is shaped so as to accommodate said dose and allow its expulsion substantially in the direction of said severing edge.

#### Brief description of the drawings

Further features and advantages will become better apparent from the detailed description of some preferred embodiments of the invention,  
20 illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a partially sectional plan view of the device according to a first embodiment;

Figure 2 is a partially sectional side elevation view, taken along a vertical  
25 plane, of the device of Figure 1;

Figure 3 is a partially sectional detail plan view of the device of Figure 1;

Figure 4 is a partially sectional front elevation view of a first constructive embodiment of the device according to the invention;

Figure 5 is a sectional view, taken along the line V-V of Figure 4;

30 Figure 6 is a partially sectional side elevation view of a second

constructive embodiment of the device according to the invention;

Figure 7 is a partially sectional front elevation view of the second embodiment of Figure 6;

Figure 8 is a partially sectional plan view of a third embodiment;

5 Figure 9 is a partially sectional plan view of a fourth embodiment;

Figure 10 is a sectional plane view, taken along the line X-X of Figure 9;

Figure 11 is a partially sectional plan view of a fifth embodiment;

Figure 12 is a partially sectional plan view of a sixth embodiment;

Figure 13 is a partially sectional plan view of a seventh embodiment;

10 Figure 14 is a partially sectional plan view of an eighth embodiment.

#### Ways of carrying out the Invention

In the examples of the embodiments that follow, individual characteristics, given in relation to specific examples, may actually be  
interchanged with other different characteristics that exist in other examples  
15 of embodiments.

With particular reference to Figures 1 to 3, the reference numeral 1 generally designates a device according to the invention for removing doses of plastic material to be fed into a molding carousel 2, as described in the above cited US patents, which is suitable to mold articles such as closures or  
20 liners. For the sake of brevity in the description of said carousel, the footing 3 of said carousel is shown schematically; said footing supports, so that it can rotate about a vertical axis A, a circular turntable 4 that is provided peripherally with a plurality of recesses 5 that constitute the article molding chamber and are part of the lower mold parts of compression-molding units.  
25 The turntable 4 turns in the direction B, so that the recesses 5 trace a circular path, designated by C, and are fed with doses 6 of plastic material.

The device 1 for removing the doses 6 comprises a disk 7, which can rotate about an axis D that is parallel to A. The disk 7 lies on a plane arranged above the turntable 4, and multiple dose removal elements 8 are  
30 rigidly coupled to its lower face and arranged along a circumference E that is

concentric to the axis D and tangent to the circular path C.

The removal elements 8 are angularly equidistant with respect to the axis D and in step with the recesses 5, so that each element 8 is superimposed on a respective recess 5 in the point of tangency F of the circumference E with respect to the path C.

As shown more clearly in Figure 3, each element 8 is constituted by an L-shaped member that is composed of a rectangular base 9 that rests on the lower face of the disk 7 and in which there are two slots 10, through which screws 11 are guided which engage in the disk 7 in order to fix the base under the disk 7.

A back wall 12 is rigidly coupled to the base 9 and is perpendicular thereto and substantially radial with respect to the axis D. A side wall 13 and respectively a severing or cutting element 14, preferably constituted by a blade, are fixed to the opposite ends of the wall 12, and form a receptacle 15 that is open, in the direction G of the rotation of the disk 7, toward the region where the doses 6 of plastic material are removed. Advantageously, the blade 14 has a cutting or severing edge 14a that is perpendicular to the disk 7 and is fixed so that it is possible to adjust the distance of the cutting edge 14a from the back wall 12.

It should be noted that the slots 10 are arc-shaped and their center is located in the receptacle 15, so as to be able to adjust their orientation with respect to the direction of rotation G of the disk 7.

The disk 7 is keyed on a vertical shaft 16 (see Figure 2), which is supported, by way of bearings 17, in a sleeve 18 that is flanged onto an arm 19 that protrudes from the top of a column 20 on which it is mounted so that it can rotate about the axis H, which is parallel to D.

The rotating disk 7 is actuated by way of an adapted motor and transmission means of the belt or gear type, which are not shown since they are fully conventional.

Proximate to the axis H, the arm 19 is provided with a lug 21, to which

the stem of a fluid-operated actuator 22 is articulated; its cylinder is in turn pivoted in the footing 3 of the carousel. The fluid-operated actuator 22 is designed to make the arm 19 perform an angular movement about the axis H and therefore along the circumference E with respect to the axis A of the carousel 2 until it more or less intersects the path C of the recesses 5, so as to adjust, according to the requirements, the extent by which each removal element 8 remains superimposed on a respective recess 5 in order to allow the doses 6 taken by the elements 8 to be deposited in the respective recesses.

10 The doses 6 to be deposited in the recesses 5 are dispensed by an extruder 23, which is provided with a nozzle 24 for the outflow of the plastic material that continues under the disk 7 and at the level of the removal elements 8. The nozzle 24 is crossed by a channel 24a, whose axis L is perpendicular to the axis D, but is axially offset, with respect to said axis D, laterally toward  
15 the point of tangency F. The channel 24a is connected to the outside through a port that constitutes the outflow orifice 24b for the plastic material. However, it is noted that in a fully similar manner the axis L can be arranged radially with respect to the axis D, achieving the same functional result.

The orifice 24b is formed by a rim 25 that is slightly concave, so as to lie  
20 on a substantially cylindrical surface, which in the specific case is concentric with respect to the axis D. In this manner, the orifice has an elliptical shape whose central axis M passes through the axis D.

The distance from the axis D of the rim 25 and of the cutting edge 14a of the blade 14 are mutually identical, so that the blade 14 can graze the rim 25  
25 during the rotation of the disk 7.

Operation of the device is as follows: with the rotation of the disk 7, the blade 14 in fact severs a dose 6 from the stream 26 of plastic material that exits from the orifice 24b of the extruder 23 during the time that elapses between the passage of two successive removal elements 8 in front of said  
30 orifice. In particular, it should be noted that the cutting edge 14a of the blade

14 allows to obtain a severing edge that advances through the stream 26 in the direction G and forms a dose 6 whose physical characteristics are uniform throughout its thickness.

Advantageously, the blade 14 and the receptacle 15 are orientated with respect to the orifice 24b so that the dose 6 can be easily accommodated in the receptacle 15, where it is retained by the surfaces of the walls 12, 13 and of the blade 14.

A fundamental prerogative of the device according to the invention consists of the fact that the arrangement of the blade 14 at right angles to the disk 7 allows to provide a receptacle 15 which, in addition to being open frontally, i.e., in the direction G toward the extruder 23, in order to receive the dose 6, is also open vertically downward so as to allow to unload the dose into the respective recess 5 of the carousel 2 by using expulsion means that consist of a jet of compressed air, possibly assisted by the mechanical action of a piston, as described in the cited US patent no. 5,807,598.

The invention is susceptible of numerous modifications and variations, all of which are within the scope of the same inventive concept.

Figures 4 and 5 illustrate a first constructive variation of the removal device, according to which the rotating disk 7 and the extruder 23 are mounted respectively so that the rotation axis D and the axis L of the nozzle 24 are horizontal and mutually parallel.

The removal elements 8 for the doses 6 are rigidly coupled to the peripheral region of the disk 7, and the cutting edges 14a of the blades 14 are arranged radially and lie on a vertical plane that is tangent to the rim 25 of the orifice 24b for the outflow of the plastic material. Below the disk there is the upper portion 27 of a conveyor belt, on which closures 28 advance in succession, acting as a replacement of the recesses 5, the doses being successively punched into said closures in order to form the sealing liners.

The unloading of each dose 6 from the containment receptacle 15 into the respective closure 28 occurs parallel to the cutting edge 14a of the removal

element 8, radially outward and in a diametrically opposite position with respect to the position for severing and removal from the outflow orifice 24b.

Figures 6 and 7 illustrate a second constructive variation of the feeder device according to the invention, in which the extruder 23 is arranged so that its axis L is vertical and the orifice 24b is directed downward. The rotation axis D of the rotating disk 7 is inclined with respect to the vertical by  $45^\circ$  and has a substantially frustoconical shape that tapers downward and forms an angle of  $90^\circ$  with the conical surface 29. In this manner, the removal elements 8 fixed onto the conical surface are orientated so that during the rotation of the disk 7 the cutting edge 14a is horizontal in the point of tangency with the rim 25 of the orifice 24b of the extruder 23 and is vertical in the diametrically opposite position in order to allow the unloading of the doses into the closures 28.

Figure 8 illustrates a third variation, in which the removal elements 8 are provided with means for retaining and releasing the doses 6. For this purpose, the side wall 13, which delimits the receptacle 15 on the opposite side with respect to the blade 14, is movable and is connected to the back wall 12 by means of an elastic lamina 30, which allows its articulation with respect to the back wall 12 between a first end position and a second end position. The position of the side wall 13 is controlled by a cam follower, which is constituted by an arm 31 that is rigidly coupled to the wall 13 and supports, at its end, a roller 32 that engages on the profile of a stationary cam 33 that is concentric to the axis D. The profile of the cam 33 is shaped so that when the blade 14 has cut the dose 6, the side wall 13 is orientated toward the blade 14 in the first end position, so as to grip and retain the dose. In a subsequent step, when each removal element 8 lies above a respective recess 5, the active release of the dose 6 can occur if this is particularly convenient in functional terms; said release is actuated by the stationary cam 33 by way of the elastic return of the lamina 30, which arranges the side wall

13 in the second end position.

Figures 9 and 10 illustrate a fourth variation, in which instead of the blade 14 there is a metallic wire 34 that is bent in a U-like shape with two portions 35 and 36 that are parallel and fixed to the back wall 12 on the opposite side with respect to the side wall 13 and are joined by a portion 37 that is meant to cut the dose and is parallel to the rotation axis C of the disk 7 for supporting the removal elements 8. A lip 38 protrudes from the wall 12, between the parallel portions 35 and 36, and facilitates the accommodation of the severed dose in the receptacle 15.

Figure 11 illustrates a fifth variation, in which the portion of the outflow channel 24a that passes through the nozzle 24 has a curved shape, such that its axis L coincides with the axis M of the orifice and is therefore radial with respect to the axis D of the disk 7: its geometry is therefore particularly suitable to achieve a correct, effective and uniform extrusion of the stream 26 of plastic material.

In a sixth constructive variation, shown in Figure 12, each one of the removal elements 8 has a side wall 13 that is articulated to the side of the base 9 about an axis N that is parallel to D. The side wall 13 continues to the rear with a tab 39 that is shaped so as to interact, in the motion of the disk 7 and according to a specific synchronization, with a cylindrical abutment 40, constituted for example by a roller that is supported so that it can rotate about its own axis, which is parallel to D, and acts substantially as a stationary cam: this allows to achieve the rotation of the side wall 13 about the axis N, from a first end position to a second end position and specifically in the direction of the opening of the receptacle 15, by the angle required to facilitate the removal of the dose 6 on the part of the blade 14. A helical contrast spring 41, whose opposite ends respectively abut against the tab 39 and the base 9, prevents the rotation of the side wall 13 from the second end position to the first end position, i.e., in the direction for closing the receptacle 15, so as to retain the dose 6 after it has been removed. It should



be noted that it may be possible, when the dose 6 is deposited in the respective recess 5, to provide an additional roller, whose axis is parallel to D and which, by interacting with the tab 39, reopens the receptacle 15, facilitating the release of said dose into the receptacle.

5 A seventh constructive variation, shown in Figure 13, differs from the sixth variation described above in that the tab 39 of the wall 13 protrudes laterally, in a substantially radial direction with respect to the axis D, and has an end portion that is in permanent contact with the end of the stem of a pneumatic piston 42 that is rigidly coupled under the disk 7. The controlled  
10 extension of said stem, according to a preset synchronization with respect to the motion of the disk 7, turns the side wall 13 about the axis N from a first end position to a second end position in the direction for opening the receptacle 15 by the angle required to allow the removal of the dose 6; the retention of said dose in the receptacle is then ensured by the actuation of the  
15 contrast spring 41, which returns the side wall 13 from the second end position to the first end position.

When necessary, the further subsequent controlled extension of the stem of the pneumatic piston 42 causes the rotation of the side wall 13 again between the first end position and the second end position, releasing the dose  
20 6 into the respective recess 5.

Figure 14 illustrates an eighth preferred variation of the device according to the invention, in which the end of the stem of the pneumatic piston 42 of each removal element 8, preferably of the double-acting type, is directly and rigidly connected to the side wall 13.

25 The controlled extension of the stem of the piston 42 when the dose 6 is removed, allows to arrange the side wall 13 substantially adjacent to the side of the base 9 in a first end position, thus closing the receptacle 15 in order to firmly retain said dose. If required by the specific application, the subsequent retraction, in step with the rotation of the disk 7, of the stem of  
30 the piston 42 allows to move the side wall 13 away from the side of the base

9, i.e., in a second end position, in order to produce the release of the dose 6 into the respective recess 5.

It has thus been shown that the invention achieves the intended aim and objects.

5 All the details may further be replaced with other technically equivalent ones.

In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of protection of the appended claims.

10 The disclosures in Italian Patent Application No. BO2002A000683 from which this application claims priority are incorporated herein by reference.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such  
15 reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.